into a perfect sponge. "Equilibrium of Animal Form," by Hans Przibram. "The Effect of Degree of Injury, Successive Injury and Functional Activity upon Regeneration in the Scyphomedusan, *Cassiopea Xamachana*," by Charles Zeleny. The present study is a part of a series of experiments whose object is the investigation of some of the internal factors controlling regeneration in several representative forms. It is found that removal of six of the eight oral arms in *Cassiopea* constitutes the most favorable degree of injury for the regeneration of each arm, and that from this optimum there is a decrease in both directions. The data for successive injury show a greater rate of regeneration of the margin of the disk after the second removal than after the first. A comparison of the rate of regeneration of the margin in cases where the disk was made to pulsate rhythmically with cases without pulsation shows no advantage in favor of the pulsating ones, but rather a retardation. "Studies in Adaptation—I., The Sense of Sight in Spiders," by Alexander Petrunkevitch. This article shows the relation between the position of the eyes on the cephalothorax and the particular locomotion in hunting spiders, and by the application of a new method makes possible the determination of the maximum angles and of the limit of vision for each eye.

SOCIETIES AND ACADEMIES

THE GEOLOGICAL SOCIETY OF WASHINGTON

AT the 200th meeting of the society, held in the Cosmos Club, on Wednesday evening, February 12, the following papers were presented:

Regular Program

The Barringer Hill (Texas) Pegmatite Dike: FRANK L. HESS.

This dike by its resistance to erosion has formed a low hill in the flood plain of the Colorado River, and was named for the discoverer. The minerals of the dike have unusually large dimensions, the quartz occurring in masses 40 feet in diameter; the feldspar in masses 30 feet across, with individual crystals having edges 34 inches long; while fluorite crystals enclosed in quartz show edges a foot long. A great variety of rare-earth metal minerals occur in the dike, of which the yttria bearing minerals, fergusonite and gadolinite are mined commercially. Allanite occurs in masses weighing over 300 pounds, fergusonite up to 65 pounds and gadolinite up to 200 pounds. So far, no other important occurrences of the rare-earth metal minerals have been found in the neighborhood.

The Structure of the Marble Belt of Fannin County, Georgia: LAURENCE LAFORGE.

The marble occurs in two lines of exposures, occupying a double valley from one to three and one half miles in width, cut about 250 feet below the general level of the region, and with a low central ridge of mica slates. Owing to strike faults, there is not a complete section, nor do the formations occur in complete normal sequence anywhere in the immediate region, and attempts to unravel the structure were unsuccessful until the key was furnished by the sequence of the formations determined by Mr. Keith in the Nantahala Quadrangle in North Carolina.

The structure shows the valley to be in general synclinal, but with a subordinate axial anticline, the two lines of marble thus occupying the lateral synclinal axes, and the slate of the central ridge belonging in a formation underlying the marble. Both the central anticline and the lateral synclines are broken by thrust faults, so that the marble occurs in discontinuous patches, and on the western side of the valley one and sometimes two of the underlying formations are faulted out. Nothing is known of the actual dip of the faults, but certain considerations lead to the conclusion that they are steeply inclined, and that the western fault is overthrust from the west, the other two being overthrust from the east.

Oxygen Values and Coal Alteration: Mr. DAVID WHITE.

Elimination of oxygen is the preeminently important feature from the standpoints both of coal efficiency and coal development. This deoxygenation, largely accomplished during the first or biochemical (putrefaction) stage of coal formation, continues during the second,

or dynamochemical stage. A comparative study of ultimate analyses shows that in practically all kinds of coals, the oxygen and the ash are of approximately equal anti-calorific value, *i. e.*, of nearly equal importance as impurities from the heat standpoint. Consequently, since the carbon-oxygen ratios of coals with the same ash closely correspond in their numerical sequence to the order of the calorific values of those coals, it follows that coals with varying ash will, if arranged according to the ratios of carbon divided by oxygen-plus ash, $C \div (O + Ash)$ stand in a sequence closely approaching that of their calorimetrically ascertained efficiencies. Of 250 coals tabulated in accordance with the latter ratios few depart as much as three per cent. from the mean corresponding to their respective ratios, and the greater number are within one per cent. The widest departures are found among the brown lignites and peats and the coals undergoing anthracitization. The comparative study shows that the anti-calorific value of the oxygen is apparently about twice as great as has been supposed. In fact, per cent. for per cent., oxygen and ash as impurities are of so nearly equal value according to the calorimetric tests of the coals as to be practically interchangeable so far as concerns the heating power of the fuel. Since the demonstration is based upon the analyses of the air-dried samples in which the water content varies widely, it would appear that the oxygen of the moisture is not far different in anti-calorific value from that of the oxygen in hydrocarbon combination. The negative value of one per cent. of oxygen, or ash, in ordinary bituminous coals is probably between 70 and 80 calories.

A further study of the analyses suggests that the quality of coking may be due to the presence of gelosic algal, or sapropelic, matter in the original ingredients of the fuel. Since fuels in which such matter has been microscopically observed generally fuse, usually with swelling, on combustion; and since the researches of Renault and Bertrand have proved the agency of gelatinous micro-algæ in storing up bitumen, it would appear probable that coals possessing the necessary quantity of such ingredients would exhibit both fusibility and enrichment by bitumen. Consequently, fuels which are shown by a relatively high per cent. of hydrogen to have been enriched by bitumen, if such enrichment is due to the presence of the above mentioned ingredients, will also possess the fusibility essential to coking, provided that the ash is not too great. The comparative study of the analyses shows that, until the point of rapid dynamic devolatilization of the semi-anthracitic stage is approached, coals which exhibit a high proportion of hydrogen as compared to oxygen (H/O) and which, therefore, may be regarded as enriched by bitumen, generally possess coking fusibility. It thus appears that the above hypothesis is supported by chemical analyses, although it may not be regarded as proven short of microscopical detection of gelosic (sapropelic) elements. In the main body of coals, between semi-bituminous and lignites, it would seem possible to forecast the coking quality from the hydrogen-oxygen ratios, moisture-free basis, of the coals.

Philip S. Smith,
Secretary

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 646th meeting was held February 29, President Bauer presiding.

Mr. John E. Burbank presented the first paper of the evening, entitled "Microseismic Tremors and their Apparent Connection with Barometric Variations."

This paper discussed a now well-known type of seismic motion which consists of short period waves of very small amplitude, lasting, generally, for hours and sometimes for three or four days. These waves show alternate maxima and minima like the phenomena of beats in acoustics.

The seismograph at the Cheltenham Magnetic Observatory recorded 75 cases between September 1, 1906, and January 31, 1908. The most pronounced tremors occurred when a deep barometric depression passed from land to sea, or *vice versa*. No marked depression passed over the coast line, between Portland, Me., and New Orleans, La., during this in-

terval of time without being accompanied by tremors which were recorded at Cheltenham. When the center of a depression passed over the coast line near Cheltenham the tremors were much more pronounced. These tremors also occurred, but with less intensity, when a pronounced high area passed over the coast line. They also occurred when the barometric changes were such as to cause sudden pressure changes over a large extent of coast line. No tremors accompany barometric depressions or sudden changes which take place wholly over land, even when comparatively near Cheltenham. The period of these minute waves is about 3.3 seconds and has no definite relation to the periods of the pendulums themselves, which varied between 18 and 28 seconds. Two cases were noted when the period was 5.0 seconds.

It was pointed out that a barometric depression when over land ought to raise the earth's surface on account of the reduced pressure, and when over the ocean the water should rise so that the pressure on the ocean bed would be practically unchanged. Any load applied to, or removed from the earth's crust by a barometric change would have an abrupt margin at the shore line.

At the conclusion of Mr. Burbank's paper Mr. W. J. Humphrey presented two papers; the first paper being entitled "Anode and Cathode Arc Spectra."

In the case of direct current arcs the spectral analysis of the light from the regions of the two poles gives very different results. When the carbons contain only small amounts of metals or their salts the metallic lines are practically confined to parts of the arc near the negative pole, while the carbon or cyanogen bands are most pronounced near the positive pole. This difference has been ascribed by some observers to a kind of electrolysis in the arc, causing an accumulation of the metallic particles on and about the negative pole. Others have considered it due to a similar accumulation of the metallic particles, due not to electrolysis, but to distillation, and to conveetion.

The author does not accept any of these theories as being both necessary and sufficient to fully account for the phenomena observed. He accepts the theory, largely due to J. J. Thomson, that the arc consists mainly of negative corpuscles moving with great velocity from the negative to the positive pole, together with an approximately equal number of positive ions moving much slower in the opposite direction. Ionization takes place mainly next the positive pole, and the positive ion or "rest-atom" drifts under the voltage of the arc towards the negative pole, where presumably the corpuscles are most numerous and have their greatest velocity.

The shocks then of these "rest-atoms" by the swiftly moving corpuscles is supposed to be the cause of the spectrum lines, which are concentrated about the negative pole simply because this is the place where the corpuscles are most numerous and most energetic.

Mr. Humphrey's second paper was devoted to the subject "The Luminous Particle a Strong Magnet."

Attention is called to the fact that, so far as we know, a magnetic field can act only on some other magnetic field; that an electric current is accompanied by a magnetic field; and that a moving electric charge is an electric current. From this it is argued that the luminous atom, whose spectral lines are changed by a magnetic field, must have a magnetic field of its own, due to negative corpuscles in some sort of orbital motion.

Attention is also called to the fact, shown by Langevin, that a ring of electrons or corpuscles when acted on by a changing magnetic field will correspondingly change its angular velocity, but not its orbital radius. This supposedly leads to a fixed self-induction for the ring, and makes it possible to calculate the electromotive force generated in the ring by any given change in the magnetic field in which the atom chances to be placed, and also the resulting current.

If the atom is constructed in general as the above experimental facts would lead us to believe, then the change in wave-length of a spectral line, when produced in a magnetic field, will bear the same relation to the undis-

turbed wave-length that the strength of the disturbing magnetic field does to the field of the atom itself.

This gives at once the experimentally established Zeeman law, that the change in wave-length, divided by the strength of the disturbing magnetic field times the square of the undisturbed wave-length, is a constant; and, by substituting known values for three of the four terms, the magnetic strength of the atom is found to be some thousands of times that of the most powerful electromagnet.

R. L. Faris,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 440th meeting was held February 22, 1908, President Stejneger in the chair.

Dr. B. W. Evermann read a paper on "Testing the Water of Small Lakes for Oxygen." The U. S. Bureau of Fisheries has for several years been devoting a portion of its appropriations to the physical and biological survey of the streams and lakes of the states and territories.

These surveys have been directed primarily to the securing of accurate knowledge regarding the fishes and other animals native to each stream or lake, the physical and biological conditions under which they thrive, and the fitness of the waters for other species whose introduction is or may be proposed.

Recently, the bureau began the examination of small lakes with particular reference to the amount of absorbed oxygen contained in their waters. Several such lakes have been examined in Wisconsin (in cooperation with the Wisconsin Natural History Survey) and several in northern Indiana. At Lake Maxinkuckee, besides dissolved oxygen, temperature and depth, the determinations included titrations for normal carbonates, bicarbonates and free carbonic acid. The surface water for a depth of a few meters was about air-saturated with oxygen. Below six meters the oxygen falls rapidly and at twelve or thirteen meters disappears entirely from the water. The dead plankton falling from the upper strata is sufficient to keep the oxygen in the depths consumed by oxidation. Protection from storms and winds which agitate the water is a factor in the lack of oxygen in such lakes.

Dr. C. Dwight Marsh referred to the effect of wind in the distribution of oxygen in lakes. While one class of lakes are shallow and hold oxygen at all depths, and another are deep and have no oxygen in the depths, there is still a third class which are deep and yet contain oxygen at their greatest depths. This last class consists usually of lakes which by their large size or exposure favor the creation of bottom currents originating in the action of wind, as by the piling up of water at one end of the lake, and the subsequent return of equilibrium.

Mr. A. H. Howell read the next paper, which was on "The Destruction of the Cotton Boll Weevil by Insectivorous Birds." This paper was based in part on Bulletins of the U. S. Department of Agriculture and in part on unpublished material. His subject was illustrated by lantern slides and by the skins of the weevil-eating birds. In reply to questions, Mr. Howell said the cotton caterpillar, itself an enemy of the cotton boll weevil, was eaten and preferred to the latter by the birds, and that the weevil, though a tough chitinous insect, was probably digested within a few hours in the stomachs of birds.

Dr. Evermann said Mr. Howell's paper emphasized the necessity of international control of migratory birds. The enactment of the Shiras bill affecting birds, mammals and fishes would be a step in this direction.

The third paper was by Mr. F. V. Coville, on "A Mistletoe Destructive to the Douglas Fir."

M. C. Marsh,
Recording Secretary

THE BOTANICAL SOCIETY OF WASHINGTON

The 46th meeting was held February 1, 1908. Vice-president C. V. Piper presided and thirty-five members were present.

The first paper was by Mr. W. J. Spillman: "Five Types of Variation under the Chromosome Theory." Mr. Spillman started with the assumption that the development of the

individual from the fertilized egg is a matter of the assimilation of food and the conversion of food materials into tissues; and that if we understood all the metabolic processes that occur in the body we might possibly be able to understand why a given egg develops into a specific organism. At present we do not know a great deal about the exact locality in which various processes occur or the cause or nature of the changes which do occur, but there are reasons to believe that the chromatin is of highest importance in assimilatory processes. The cytoplasm also, at least in some of the cells of the body, must also take an important part. Inheritance is easier to understand than development. The gamete, composed of certain substances built into more or less definite structures, is so organized that by assimilation of food the cell is able to reproduce itself. Important differences frequently appear when we pass from one generation to the next.

1. One of the most important, and by far the most common cause of variation, lies in the new groupings of hereditary characters which occur when two gametes unite, the preparation for the new grouping having been made in the formation of the gametes. Any definite structures in the cell which have important functions in the metabolism of food and which retain their identity in passing from one cell to another may determine important differences between parent and offspring. The facts of Mendelian inheritance indicate that there are such definite structures which become rearranged with the production of new gametes and their subsequent union. We may include here all variation due to recombinations of Mendelian unit characters.

2. The definite structures of the cell, which because of their composition bear definite relations to metabolic processes, may, by change in composition or in environment, change in their relation to the metabolic processes. Speaking in a general way, the development of the numerous varieties of domesticated species seems to have arisen from the loss of functions formerly possessed by definite structures within the cell, perhaps in the main the chromosomes. The author, to support this supposition, gave illustrations of the variation in color in domesticated hogs, and called attention to de Vries' application of the same theory to explain the origin of the numerous varieties of cultivated plants.

3. New functions may be acquired by cell organs causing new characters to appear. It is supposed that evolutionary progress in the main is of this character. Such changes may be slow and gradual or instantaneous.

4. Change of environment may cause marked changes, as in the case of the cassava plant, which loses its prussic acid when brought from the tropics to Louisiana. Hard wheat taken to the Pacific coast becomes soft in a few years. Champion tomatoes from seed grown in Pennsylvania produce Champion tomatoes in Louisiana, but the seed produced in Louisiana yield a very different type of tomato. These variations are probably due to changes in metabolic activities, perhaps in the chromatin and in the cytoplasm. Such changes may be reversible or not. This particular phase of variation offers to the student an inviting field in which too little work has been done.

5. Loss or gain of chromosomes resulting from accidents in cell division may cause important variations. Recent investigation indicates that we may find here an explanation of the so-called mutations of de Vries.

Professor Spillman's paper was followed by a prolonged discussion.

The second paper, "A Root Disease of Tobacco," by Mr. W. W. Gilbert, was an account of the disease caused by the fungus *Thielavia basicola*, which is the subject of a forthcoming bulletin of the Bureau of Plant Industry.

Under the title "Some Peculiar Seedlings" Professor J. B. S. Norton described a series of experiments in germinating immature seeds of the cowpea. From the time of fading of the flowers he collected seeds at intervals of three days. He found that those which were three weeks from the seed, about one tenth normal size, sprouted and produced slender but normal plants.

Mr. J. H. Painter, of the United States National Museum, then gave an account of

"The Present State of the Study of the Flora of the District of Columbia."

The last paper on the program was by Mr. Charles J. Brand, of the Bureau of Plant Industry, who discussed a new variety of alfalfa (*Medicago sativa* L. var. *polia* Brand) based on plants grown from seed of Peruvian origin, quite distinct from forms of the species hitherto known. Inasmuch as the plant promises to be of considerable agricultural importance, Mr. Brand raised the question of the desirability of applying varietal names in the taxonomic sense to distinct forms of our important crop plants. The paper, which included a discussion of previously recognized varieties, aroused an interesting and spirited discussion.

W. E. Safford,
Corresponding Secretary

THE TORREY BOTANICAL CLUB

The club was called to order on February 26, 1908, at the Museum of the New York Botanical Garden at 3:45 P.M. Ten persons were present.

The scientific program was as follows:

Remarks on the Genus Boletus: William A. Murrill.

This paper will be published in the March (1908) number of *Torreya*.

Some Fern Hybrids: Ralph C. Benedict.

The object of this paper was to present general facts regarding fern hybrids, to indicate the apparent significance of the facts, and to show examples of some native hybrids.

The literature on the subject seems to be very scanty, and consists principally of scattered descriptions of natural and horticultural hybrids. Lowe ("Fern Growing") has given a general discussion of the subject, but his work is of a horticultural, rather than of a scientific, value. The most conclusive experiments are those carried on by Miss Margaret Slosson, in which she reproduced culturally *Asplenium ebenoides* (*A. platyneuron* × *Camptosorus rhizophyllus*) and *Dryopteris cristata* × *marginalis* Davenport, two suspected hybrids, which occur in nature. Recently, at least one more cross has been artificially produced by Mr. Amedee Hans, of Stamford, Conn., between *Dryopteris Filix-mas* and *D. marginalis*. This, however, has not yet been found wild.

Study of these three authenticated hybrids shows that they agree in general with the hybrids of some flowering plants. They are sterile, usually larger than the parents, sometimes abnormal, and in many characters intermediate to a greater or less degree between the parent species. In view of these facts, it seems reasonable to interpret as hybrids other forms (principally in *Dryopteris*) which are sterile and similarly intermediate between two species.

Some of these are very characteristic and might be considered separate species. At least two have been so described. This view, however, is untenable because of their sterility, and their distribution, rare or occasional with the parent species, or at least in a locality where these grow or have grown. That they are mutations seems very doubtful, because the actual differences are so great, and especially since in these differences they resemble the other reputed parent. For example, sterile intermediates are known between *Dryopteris marginalis* and six other species. Some resemble *marginalis* most, some the other species, but all agree in possessing distinctive characters of each of two species. For similar reasons, these forms can not be satisfactorily explained on ecological grounds.

If it is objected that fern hybrids must, because of the conditions required for the transference of spermatozoids, be too rare to account for these plants which are rather common, it may be said that *Dryopteris cristata* × *marginalis*, one of the authenticated crosses, is the commonest of them all. It may be expected in any swampy woodland where the parent species occur. This being the case, we are bound to expect the other forms to be found at least occasionally, and it seems only logical to conclude that such intermediate sterile forms as are analogous in general characters to *D. cristata* × *marginalis*, belong in the same category, and are likewise hybrids.

In the region in which the writer has studied these plants, *Dryopteris* is represented by six specific units which seem to hybridize more or less readily, representing a total of fifteen possible combinations of two species. Of these fifteen, two are already described. Of the remaining, probably eleven have been found, and descriptions for most of these are in preparation, some by Miss Slosson, some by Dr. Philip Dowell and some by Mr. Benedict.

Both papers were discussed at length.

C. STUART GAGER,
Secretary

THE AMERICAN CHEMICAL SOCIETY
NEW YORK SECTION

THE sixth regular meeting of the session of 1907–8 was held at the Chemists' Club, 108 West 55th Street, on March 6.

The annual election of officers, to assume their duties at the close of the June meeting following, was held with the following result:

Chairman—Leo H. Baekeland.
Vice-chairman—F. J. Pond.
Secretary and Treasurer—C. M. Joyce.
Executive Committee—H. C. Sherman, Geo. C. Stone, Morris Loeb, Arthur B. Lamb.

The following papers were read:

"The Electrolytic Determination of Bismuth," by F. J. Metzger and H. T. Beans.

"Some Principles in Laboratory Construction," by Chas. Baskerville.

"A Method of Analyzing Shellac," by P. C. McIlhiney.

"Studies in Nitration, IV.: Melting-point Curves of Binary Mixtures of Ortho-, Meta- and Paranitranilines: A New Method for the Determination of Such Mixtures," by J. Bishop Tingle and H. F. Rolker.

C. M. JOYCE,
Secretary

DISCUSSION AND CORRESPONDENCE

COOPERATION IN SCIENTIFIC BIBLIOGRAPHY

THE recent report of Dr. H. H. Field, founder of the Concilium Bibliographicum of Zurich, Switzerland, contains a discussion of the relations which this central international agency for recording and making accessible information regarding publications in certain sciences bears to publishers and editors in these fields, which is of wide interest to all who wish to forward the success of this most valuable aid to science.

This bibliographical institute was founded officially by the International Congresses of Zoology and Physiology and for a decade has been subsidized by the Swiss Confederation, the city and canton of Zurich, the Swiss Bureau of Education, the French Zoological Society and learned societies in other countries. It is the work of the Concilium to examine the scientific periodical literature of the world, and also that which appears in reports, memoirs, bulletins of irregular and discontinuous publication, as well as the formal volumes of the regular book trade, and prepare accurate bibliographical lists of the same. The Concilium issues at present a series of bibliographical cards in zoology and another in physiology. The cards in zoology cover also the fields of general biology, microscopy, paleontology and anatomy. To these sciences which lie on the dividing line between medicine and the natural sciences it is intended to add progressively new branches. Movements have been started looking toward the extension of this work into other fields of science and the Concilium has come to be considered as the natural center about which all work of this nature tends to group itself. Alliances are even now being sought by the leading bibliographies in botany, anthropology, geology and mineralogy. Further extensions into the field of medicine are also sought, while negotiations regarding forestry and electro-chemistry are pending. Dr. Field very justly calls attention to the fact that the usefulness of the Concilium in making known new publications is not limited to printed matter appearing under its immediate editorship; to wit, in the "Bibliographia Zoologica" and "Physiologica" and the bibliography cards founded thereon. The work here done is the starting point for the reviews and summaries which appear later in the *Zoologischer Jahresbericht* and the much belated *Archiv für Naturgeschichte*. The recorders of *Zoological Record* and the *Année Biologique* depend also to no small degree upon the Concilium